IP2: IMAGE PROCESSING IN REMOTE SENSING
EXERCISE 4

Due Date: Mo. 30.06.2014, 8 am

Scope: Microwave Remote Sensing

Please send your solutions via e-mail to: germer@informatik.uni-hamburg.de

Use the subject "IP2-Ex4 GROUPNAME" and write your solutions

- Either as plain text or
- Convert them to PDF and attach the PDF to the mail.

1 RADAR REMOTE SENSING BASICS 6 P.

a) Explain the general setup of an active Microwave Scanner, e.g. by means of a space-borne altimeter.

b) The development of high-power solar panels was of huge importance for Microwave Remote Sensing. Explain why!

c) Explain the underlying principle of satellite based scatterometry w.r.t to wind measurements over the oceans surface.

2 BASIC RADAR SENSORS 6 P.

a) Assume that you have a push broom Microwave scanning system at X-Band (=10 GHz) in an orbit with an altitude of 514 km. The antenna has a size of 3.5 m. How large is the footprint of the emitted radar beam?

b) Explain briefly why Side-looking Radar is necessary for microwave imaging. Compare the setup with (down facing) optical systems.

c) Assume, a Side-looking Radar with the same properties as in (a), but with a pulse length of 20 µs and incidence angles from 20° to 45°. Give the pixel sizes of the resulting image for the first and the last pixel of each scan line.

3 SYNTHETIC APERTURE RADAR 12 P.

a) Explain the main problems of conventional Radar and the key ideas that the SAR technology is based on.

b) Determine the size of the antenna, which is needed for the satellite in 2(a) to achieve an azimuth resolution of 10 m.

c) Assume, that you use the setup given in 2(c), but with a chirp pulse-compression factor of 500. Determine the new pixel sizes.

d) Which azimuth resolution is achieved, if the SAR technique is applied?

3 SPECKLE NOISE 6 P.

a) Explain the creation of speckle noise in SAR imagery. Why may “noise” not be an appropriate name?

b) Which techniques are used to decrease the speckle in SAR images?

c) Give the number of operations (without filter kernel creation) for a Frost Filter of size 5x5 and an image of size 10 000x10 000 pixels. What if you raise the filter size to 11x11 pixels? Compare the computation times for a computer, which performs operations at 2,5 GHz.

Total points: 30